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necessary check upon computations. Many of the corrections to the instrument, which enter as corrections to the original results of observation, are largely eliminated in the computed places of the stars, since the right ascensions of the fundamental stars are adopted as standard, but the discussion of every source of error has its real value.

LICK OBSERVATORY, January 20, 1915.

PLANETARY PHENOMENA FOR MARCH AND
APRIL, 1915.

BY MALCOLM MCNEILL.

PHASES OF THE MOON, PACIFIC TIME.

Full Moon ... Mar. 1, 10 ^h 33 ^m A.M.	Last Quarter.. Apr. 6, 12 ^h 12 ^m P.M.
Last Quarter.. " 8, 4 28 A.M.	New Moon.... " 14, 3 36 A.M.
New Moon.... " 15, 11 42 A.M.	First Quarter.. " 22, 7 39 A.M.
First Quarter. " 23, 2 48 P.M.	Full Moon.... " 29, 6 19 A.M.
Full Moon.... " 30, 9 38 P.M.	

The Vernal Equinox, the time when the Sun crosses the celestial equator from south to north and enters the sign (not the constellation) *Aries*, occurs on March 21st about 9 A.M. Pacific time.

Five of the planets, *Mercury*, *Venus*, *Mars*, *Jupiter* and *Uranus* are morning objects, but not all are far enuf away from the Sun for naked-eye observation. Their motions are apparently quite complicated.

Mercury passed inferior conjunction with the Sun on February 21st, and by March 1st rises not quite an hour before sunrise. Its apparent distance from the Sun increases until the morning of March 20th, when it reaches greatest west elongation $27^{\circ} 44'$. It then rises a little more than an hour before sunrise. The distance from the Sun then begins to grow smaller so that by the end of the month the interval between the rising of the Sun and of the planet is somewhat less than an hour. The interval during April grows continuously smaller, and superior conjunction is reached on May 1st. Thus the

conditions for visibility are not very good, as the planet is not easily seen to naked-eye view when the interval is less than one hour; but for a few days about the time of greatest elongation it may be seen low down in the morning twilight, rising nearly 15° south of the sunrise point. This position, south of the Sun, is the cause of the small interval between the planet's rising and sunrise, as the apparent distance from Sun to planet is about 50 per cent greater than it was at the greatest east elongation in early February, when the planet remained above the horizon for nearly an hour and a half after sunset. *Mercury* is in conjunction with *Mars* on February 28th, with the Moon on March 13th, with *Jupiter* on March 29th, and with *Mars* on April 3d.

Venus is also a morning object, rising $2^h 20^m$ before sunrise on March 1st, and the interval diminishes steadily, so that by the end of April it is only $1^h 18^m$; but the great brightness of the planet makes it a conspicuous object thruout the period, altho the planet has lost much of its brilliance since early January. It is in conjunction with *Uranus* on the night of March 18th, and a very interesting conjunction with *Jupiter* will occur on the morning of April 15th. At the time of nearest approach the apparent distance between the planets will be only $0^\circ 9'$, less than one third of the apparent diameter of the Moon. This nearest approach occurs about 8 A. M. P. S. T., some time after sunrise in the United States.

Mars is also a morning star, gradually moving farther away from the Sun. On March 1st it rises $0^h 37^m$ before sunrise and at the end of April a little more than one hour before, so that it is gradually getting into position for naked-eye view. Its conjunctions with *Mercury* and *Venus* have already been mentioned. There is also a very close conjunction with *Jupiter* on the evening of March 23d, both planets being below our horizon at the time, the least distance between the planets being only $0^\circ 12'$; but on the mornings before and after they will be quite close together. *Mars* passes to the south of *Jupiter*, with relative motion from west toward east. *Mars* is beginning to brighten up perceptibly, being at the end of April 50 per cent brighter than it was when at its greatest distance from the Earth in November, 1914. In April it will be brighter

than the Pole star. Its distance from the Earth during that month is a little more than two hundred million miles.

Jupiter passed conjunction with the Sun on the morning of February 24th and on March 1st rises only 6 minutes before sunrise, but the apparent distance between the bodies increases somewhat rapidly, so that on April 1st it rises about an hour before sunrise and at the end of the month nearly two hours before. Its great brightness makes it an easy naked-eye object in the morning twilight some time before the end of March. Its conjunctions with other planets have been previously mentioned.

Saturn is in fine position for evening observation, remaining above the horizon until about half-after two on March 1st and about half-after ten on April 30th. It moves rather slowly, about 4° , eastward in the border region between *Taurus* and *Gemini*, a few degrees south and east of β *Tauri*. As seen in the telescope, the minor axis of the rings is about 45 per cent of the major axis; so the rings are nearly at their maximum breadth.

Uranus is a morning star, rising on March 1st a little more than an hour before sunrise, and this interval increases rapidly, so that by the end of April it rises before two o'clock. However, the planet is so faint, only about sixth magnitude, that it is a difficult naked-eye object when it is less than two hours above the horizon. It is in the eastern part of the constellation *Capricorn* and moves about 2° eastward and northward during the two months.

Neptune is in good position for evening observation, but being only eighth magnitude it is too faint to be seen without a telescope. It is in the constellation *Cancer*, and passes the meridian somewhat south of the zenith at 9:26 P. M. on March 1st and at about 5:30 on April 30th.